present, and it will not be effected in the presence of objects Haich tend to cool the gases.

This flame has a *soft and languishing* character, and an average temperature in the neighborhood of 1100°, and is employed exclusively in chamber brick kilns, tempering furnaces, annealing furnaces and furnaces used in the manufacture of plates and sheets.

It is only in the very large chamber brick kilns, where the radiation losses are insignificant, that it is possible to obtain a temperature in the neighborhood of 1400° with this kind of combustion.

If, on the other hand, it is necessary that the reaction of combustion should be completed rapidly, the actual temperature realized will be a little lower than the computed temperature. In this case it will be necessary to have an excess of air and an intimate mixture of the air and gases forming the flame. The greater the excess of air, the greater will be the proportion of the high temperature core in the flame.

A flame with a great excess of air is *sharp and penetrating* and is frequently more detrimental than useful in the uniform heating of material. It can be used in the puddling furnace or in the melting of iron, where the temperature in the furnace, as required by the process, very closely approaches the temperature of the hot flaming gases, or where the operation to be performed somewhat resembles that required of the gas welding or cutting torch.

The slowness and diffusion of the energy in the reaction of theoretical combustion is a phenomenon which is utilized in a number of ways, when it is desired to have a temperature which is not very high, but which is uniform (for tempering, annealing, the reheating of plates, etc.). In these cases, the reaction of combustion is slowed down by using cold air and gas which are not well mixed, in a very large combustion chamber out

of contact

I , c , with cold material. An ideal combustion chamber for a furnace

of this character would be a high free space under a roof or dome, from which the currents of hot gases produced by combustion would fall, and in which the hot flaming gases would always be in contact with incandescent brickwork.

In practical work the composition of the furnace gases may be assumed, according to the character of the product. Five cases are presented here.

1st Case.—Small furnaces, within which the hot gases remain only a fraction of a second and are directed *immediately* upon a.